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UNITED STATES PATENT APPLICATION

FOR

MULTI-MODE LED INDICATORS FOR RECORDING DEVICES

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BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to output displays for multi-track recorders. More particularly, the application relates to a method and apparatus for indicating modes of operation of each individual track in a multi-track recording system.

(2) Related Art

Recording studios have traditionally used multi-track recording systems to record elements of a production. Each element is recorded on a corresponding track in the recording system. Each multi-track recorder typically handles eight to sixteen tracks per recorder. A mixer may control multiple networked multi-track recorders. Thus, a recording engineer may monitor over a hundred tracks in a network.

Each track of the multi-track recording system is typically connected to one control of a mixer. Each track may be individually controlled, thus a track may have its gain independently increased or decreased. Each track may also be "slipped" relative to other tracks in the system. In such a slipped mode, the track may be repositioned in time with reference to the other tracks.

The number of tracks and the variety of independent controls makes it very difficult for a recording engineer to coordinate and monitor the status of each individual track. For example, it is difficult to tell when a particular track in the multi-track system is recording or playing. Each track typically has a corresponding level meter using a plurality of level lights indicating the signal strength of the information being received or output by the corresponding track. The level meters are, in one embodiment, a plurality of light emitting diodes.

Prior art multi-track recording systems required that the recording engineer check a series of switches to determine whether a particular track was recording, playing, or stopped. The recording engineer is also required to check switch settings to determine whether level meters are outputting the signal strength of recorded material or whether the level meters are outputting the signal strength of signals being received by the multi-track recording system. Whether the track is ready for monitoring, whether a particular track is suitable for edits or whether a track was slipped (repositioned in time with respect to other tracks) were also determined by checking switches. Determining the status of many tracks by checking switch positions for a large number of tracks is cumbersome. Thus, a compact method and apparatus for quickly assessing the status of a track is desirable.

BRIEF SUMMARY OF THE INVENTION

A method and apparatus for indicating the status of a track in a multi-track recorder. In particular, an indicator light capable of outputting different colored lights is used. The indicator light corresponds to a track in the multi-track recorder. The color and the blinking sequence of the indicator light indicates a status of the track.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of an overall multi-track recording system as used in a studio environment.

Figure 2 is an example of a display of a multi-track recording system.

Figure 3 is a chart of the modes of the multi-track recording system and the transport status with a corresponding LED indication color.

Figure 4 is a flow diagram illustrating the step executed by software in the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 illustrates an overall recording system 100 including a receiving device such as microphones 104, 108 which receive a sound signal from a source (not shown). The microphones 104, 108 transfer the signal to a mixer 112. Mixer 112 typically has a plurality of individual controls 116, 120. A recording engineer uses each individual control 116, 120 to adjust the gain to a corresponding individual track being recorded.

In one arrangement, the output of the mixer is transferred to a multi-track recorder. In more sophisticated set-ups, the output of the mixer 112 is transferred to a network 124. Network 124 may include a network manager such as a computer system or other networking device 128 which coordinates the flow of data to a series of multi-track recording devices 132, 136, 140. Networking device 128 may include a resource manager and/or a remote client program. The network device runs software which monitors and controls the inputs to the various multi-track recording devices 132, 136, 140. The network device 128 may be implemented using a multi-track recorder or using a computer.

Figure 2 illustrates one configuration of a recording display for multi-track recorders 132, 136, 140. The recording display 200 includes track displays 204, 208 which identify track numbers corresponding to nearby level meters

212, 216. Track displays 204, 208 are typically silk-screened numbers on a display panel 200. Level meters 212, 216 are typically used to display the signal strength of a signal corresponding to a track. The signal strength displayed by level meters 212, 216 may be the recorded level of the track. Alternately, the level meters may be used to indicate the signal strength of a signal being received from the microphones or the mixer 112. In a record mode, the signal received from the microphones or the mixer 112 is the signal which is recorded.

Indicator lights 220, 224 positioned in close proximity to track display 204, 208 and level meters 212, 216 are used to identify the mode or operation of the track. By varying the color of the indicator light or the (blinking sequence) of the indicator lights 220, 224 a recording engineer can quickly identify the status of a particular track without referring is multiple indicators at different areas of the workplace.

Indicator lights 220, 224 may be implemented in different ways. In one embodiment, two light emitting diodes (LEDs) are placed in close proximity to each other in a single transparent housing. The transparent housing makes it appear as if the two LEDs are one single LED light. The housing including both LEDs form the indicator light 220, 224. When one LED is switched on, the indicator light 220 outputs the color of the first LED. When a second LED is

switched on and the first LED turned off, the indicator light 220 indicates the color of the second LED. When both LED's are switched on, the indicator light 220 outputs a color which is the combination of the two LEDs. Thus, if the first LED is red and the second LED is green, the combination of the two LED's together will make indicator light 220 appear as orange or amber colored.

Figure 3 illustrates a chart showing the output of indicator lights 220 corresponding to the status of a track. The status of a track takes into account transport movement and the mode of a track. In traditional designs, a transport mechanism of the multi-track recorder device moves a recording tape across the recording heads of a multi-track recording device. In digital recording systems, an actual transport mechanism may move a tape or other mechanisms may be used for recording digital information; however, even in recorders without a moving tape, the data is digitally manipulated to simulate traditional play, reverse, rewind, stop and record functions.

The status of the transport mechanism is horizontally displayed in chart 300. In play mode 308, previously recorded material is output to the level meters 212, 216 and connected speakers. In reverse play 310, the contents of the recorded material is played in reverse. Fast forward 312 quickly forwards through previously recorded material while rewind 314 quickly goes back over previously recorded

material. A stop mode 316 places the multi-track recording system in a waiting state. Record mode 318 allows the system to record incoming signals.

Non-transport related modes of the multi-track recorder device are shown in a vertical column entitled MODE 320. In a READY AUTO INPUT ON mode 322, the user is listening to recorded material in all modes except stop. When the stop mode is used with the ready auto input on mode, the multi-track recording system outputs an "input signal" received from a source external to the multi-track recorder. When the multi-track recording system is in a ready mode but the AUTO INPUT OFF mode 324 is active, the output of the multi-track recording device is the prerecorded material. When the multi-track recording device transport is stopped 316, while a track is in an AUTO INPUT OFF mode, the multi-track recording device outputs silence.

A MONITOR MODE 326 allows the user to set-up or to enter tracks to be mixed into a headphone or other output device. Other modes which allow manipulation of data are SLIPPING CHANNELS mode 328 which allows tracks to be displaced with respect to a referenced time and LOCATE EDITS 330 mode which allows rapid finding of edit points. An INPUT/OUTPUT gain adjustment 332 mode allows a user to adjust the gain of a selected track.

The colors indicated in chart 300 indicate the output of an indicator light for a particular combination of transport 304 modes and non-transport modes 320. In general, the ready mode corresponds to a first color, (red in the example) the monitor mode corresponds to a second color (green in the example) and edit mode such as slip track and locate edits correspond to a third color (amber in the example). A blinking light and a solid light may also be used to indicate whether the transport is playing, fast-forwarding or recording. When the user is listening to recorded material and the track is armed (ready to record), the indicator light blinks red.

Alternating different colored lights may also indicate a transport mode and non-transport mode combination. For example, when the transport 304 is stopped and the non-transport mode is in a READY AUTO INPUT ON state, the indicator light blinks a first color and a second color in an alternating sequence. In the described embodiment, the alternating sequence indicates that the system is ready to record or play, but the transport is currently stopped. The alternating blinking sequence also indicates that corresponding level meters are outputting the level of an input signal which is not being recorded. The blinking indication avoids confusion regarding whether the level meter output is material recorded on the tape.

Figure 4 is a flow chart indicating the steps typically taken by a processor running a software program to implement the invention. In one embodiment, the software program runs on a processor in the multi-track recording device or the networking device 128. In step S404, the processor checks the non-transport mode of the multi-track recording device. In step S408, the processor determines whether the multi-track recording device is in a ready mode. If in step S412, the multi-track recording device is not in a ready mode but is in a monitor mode, the indicator light outputs a solid green signal in step 416. When an edit mode is detected in step S420, the indicator light outputs a solid amber colored light in step 424 .

When the system is in a ready mode as determined in step S408, the processor determines whether the track in the multi-track recording system is in an AUTO INPUT mode in step S426. When the multi-track recorder is not in an AUTO INPUT mode, the transport modes are checked in step S428. When, in step 430, it is determined that the transport mode is in a RECORD mode, the indicator light outputs a solid red color in step S432. A determination that the transport is not in RECORD mode results in a blinking red indicator light output in step 434.

When the multi-track recorder is in a READY AUTO INPUT ON mode, the transport mode is checked in step S436 to determine whether the transport of the multi-track recorder

is in a record mode in step S438. When the transport is in a record mode, the indicator light outputs a solid red color in step S440. In step S442, the processor determines whether the transports are stopped. When the transport is not stopped and while the multi-track recorder is in a READY AUTO INPUT ON mode, the indicator light outputs a blinking red signal in step S444. When it is determined in step S442 that the transport is stopped while the multi-track recording device is in a READY AUTO INPUT ON mode, the indicator light outputs an alternating red and green signal in step S446.

While certain exemplary embodiments have been described in detail and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention is not to be limited to the specific arrangements and constructions shown and described, since various other modifications may occur to those with ordinary skill in the art.